HEALTHDYNE®
TECHNOLOGIES

CHECKOUT PROCEDURE MANUAL

Home Models

900S, 900SL, 950S, 970S, and 970SE SmartMonitors

Types 01, 1A, 1B, 1C, 02, 2A, 03, and 3A

Hospital Models

900S-10 and 970SE-10 SmartMonitors

Type 01 and 1A

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Home Models

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Hospital Models

900S-10, 970SE-10

SMARTMONITOR SERIES

TABLE OF CONTENTS

Introduction 1
Equipment Needed 1

Section I. Checkout Procedure for SmartMonitor

Important Things to Remember 2

Alarm Setpoints. 3

Functional Self-Test 5

Setup 7

Verification of Respiration Signal Sensitivity
For Home SmartMonitors Types 1A and 1B 8
For All SmartMonitors Except Home Types 1A and 1B 10

Verification of the ECG Signal Sensitivity. 12

Verification of the Apnea Alarm and Delay 13

Verification of Low Breath Rate Alarm 14

Verification of Low and High Heart Alarms 15

Verification of Cardiogenic Artifact Rejection. 15

Verification of Loose Connection Alarm 16

Verification of Accidental Power-Off Alarm (Sibling Alarm) 16

Operational Verification of the Batteries 16

Operational Verification of Remote Alarm. 17

Section II. Checkout Procedure for Memory System

Introduction. 18

Testing Objective 18

Computer Retrieval of SmartMonitor Data. 19

Sample E-GRAM® Reports 21

SmartMonitor Acceptance of New Equipment Parameters from Computer. 23

Insert: *SmartMonitor Operational Verification Checklist*

INTRODUCTION

This manual is intended to provide the procedures that are used to determine if the Healthdyne Model 900S, 900SL, 950S, 970S, and 970SE Home SmartMonitors and the Model 900S-10 and 970SE-10 SmartMonitors for Hospitals and their accessories are suitable for use in patient applications. These procedures require the use of a calibrated Model 5000 Simulator which is the source of ECG and respiratory test signals. No other simulators are acceptable for use with these procedures.

Operational information for the SmartMonitors may be found in the *Professional Operator's Manual.* This manual is provided for performance testing. It is not intended as a service or repair guide.

This manual is divided into two sections. The first section covers checkout procedures for all SmartMonitors as "stand-alone" cardiorespiratory monitors. The second section is for the 900SL, 950S, 970S, 970SE, and 970SE-10 SmartMonitors only, and tests the memory system and the ability to send and receive data between the SmartMonitor and the 9500 Series software.

The procedures contained in this manual should be performed between each patient use or every 6-12 months. Monitors which have been used in a home environment should always be tested between patients.

All SmartMonitors must pass the procedures in Section I before being used on patients. The 900SL, 950S, 970S, 970SE, and 970SE-10 must also pass the procedures in Section II before being used with a patient or with the 9500 Series software.

EQUIPMENT NEEDED

- Model 900S, 900SL, 950S, 970S, or 970SE Home SmartMonitor; or Model 900S-10 or 970SE-10 SmartMonitor for Hospitals
- Model 5000 ECG/Respiration Simulator
- Model 9520-1 Safety Lead Wires (Home Models)
- Model 9185H Safety Lead Wires (Hospital Models)
- Model 9185A Lead Wire Adapters (Hospital Models)
- Model 908 Patient Cable (Home Models)
- Model 918 Patient Cable (Hospital Models)
- Model 913 Battery Charge (Home Models)
- Model 914 Battery Charger (Hospital Models)
- Model 9500 Series Software (900SL, 950S, 970S, 970SE, and 970SE-10 only)
- Model 9400, 9600, 9700, 9750, or 9800 Printer (900SL, 950S, 970S, 970SE, and 970SE-10 only)
- Model 9450 or 9650 Printer Cable (900SL, 950S, 970S, 970SE, and 970SE-10 only)
- Model 9150 or 9151 Monitor Cable (900SL, 950S, 970S, 970SE, and 970SE-10 only)
- Stopwatch

SECTION I. CHECKOUT PROCEDURE FOR SMARTMONITOR

Important things to remember as the checkout procedures are being done:

1. All the checkout procedures should be completed in one continuous operation and in the order described in this manual. If you have not performed the checkout before, please read and understand the manual before starting the checkout procedure.

2. Make sure the SmartMonitor and the Simulator are not placed near electrical appliances that could cause interference (i.e., cordless or cellular telephones, air conditioners, vaporizers, computers, TVs, VCRs, microwave ovens etc.).

3. Coiling and/or manipulation of the patient cable or lead wires should be minimized.

4. Once changes have been made on the simulator, do not maintain hand contact with the simulator knobs or enclosure. It may affect the ECG and respiration signals.

5. Because the signal from the simulator is interrupted by each change in the simulator setting, allow approximately ten seconds after each setting change for the monitor circuitry to stabilize.

6. The events for checking the data storage and retrieval capabilities of the 900SL, 950S, 970S, 970SE, and 970SE-10 are generated during the stand-alone and computer tests.

7. In Section I of the checkout procedure, the changes to the alarm parameters of all SmartMonitors should be made through the menu display located on the bottom panel of the SmartMonitors (on the front panel for -10 Models).

8. The 5000 Simulator will not function correctly if the 9-volt battery is low. It should be replaced monthly or more often with heavy use. The battery voltage can be too low for calibrated output signals *prior* to activation of the LOW BATTERY light.

9. The SmartMonitor's memory should be cleared prior to performing the checkout procedures.

10. Do not connect the SmartMonitor to the computer system while performing the Section I Checkout Procedures.

11. When testing the 950S, you should always turn the QRS off.

12. The 990 Remote Alarm may be verified throughout the checkout procedures. The Remote Alarm will not function correctly if the 9-volt battery is low. It should be replaced monthly or more often with heavy use.

SECTION I. CHECKOUT PROCEDURE FOR SMARTMONITOR

ESTABLISHING INITIAL ALARM SETPOINTS

1. Remove the Menu Display Cover from the bottom of the Home SmartMonitor (only). Note the three buttons to the right of the LCD display - PRIOR, NEXT, and ENTER.

2. Access the Menu Mode of the SmartMonitor.

   - Press the POWER button to ON.
   - Within ten seconds enter the following key code:
     1. Press the PRIOR button once.
     2. Press the NEXT button twice.
     3. Press the ENTER button three times.

   While in the Menu Mode, the SmartMonitor will beep every 30 seconds. (The Home SmartMonitor Types 1B and 1C will beep once every 10 seconds.) This is to remind you that the SmartMonitor is not monitoring and to power off the SmartMonitor after parameters are set.

3. To set a specific parameter or series of parameters:

   1. Use the NEXT button to move forward to the parameter to be changed.
   2. Select the parameter to be changed by pressing the ENTER key - this will cause the current value to flash.
   3. The value can be increased by pressing the NEXT button and decreased by pressing the PRIOR button.
   4. To select the displayed value, press the ENTER button. The value displayed will continue to flash until you press the ENTER button.
   5. Press the NEXT button to proceed to the next parameter to be selected.

4. Press PRIOR to display CLEAR MEMORY?, then clear the memory. For Types 1A, 1B, and 1C, use your 9500S Computer System to clear memory.

5. For the purposes of this checkout procedure, set the SmartMonitor parameters to the following values:

PARAMETER	VALUE
	All Models
Apnea Alarm Time Delay	20 seconds
Low Breath Rate Alarm	Off
Bradycardia Alarm	80 BPM
Bradycardia Alarm Delay	5 seconds
Tachycardia Alarm	230 BPM
Rate Display	On

ESTABLISHING INITIAL ALARM SETPOINTS (continued)

PARAMETER	VALUE		
	900SL	950S	970S Series
Oximeter Event Delay	N/A	N/A	5
Record Mode	Event	Event	Event
Pre/Post Time	N/A	45/15	45/15
Impedance	N/A	On	On
Heart Rate Trend Signal	N/A	On	On
QRS Record	N/A	Off*	On
Channel 3 Record	N/A	Off	Off
Channel 4 Record	N/A	Off	Off
Apnea for Record	16 secs	16 secs	16 secs
Bradycardia for Record	90 BPM	90 BPM	90 BPM
External Inputs	Off	Off	Off

* = Setting MUST be off.

If you press the NEXT button to move forward through the list after these parameters have been entered, the first two parameters - **Standard Alarm Parameters** and **Standard Record Paramtrs** will both read **Not Selected**. ***DO NOT*** *change these two parameters to* ***Are Selected*** *- Yes.*

After the designated checkout parameters are entered, turn the SmartMonitor off using the proper Power-Off procedure:

- Press and hold the RESET button (Home Models only).
- Press and release the POWER button.
- Wait two seconds, then release the RESET button (Home Models only).

SECTION I. CHECKOUT PROCEDURE FOR SMARTMONITOR

THE FUNCTIONAL SELF-TEST

1. Plug the Battery Charger into a grounded, live wall outlet and connect the other end (metal side up) into the receptacle on the back of the SmartMonitor labeled POWER INPUT. The CHARGER light on the front of the SmartMonitor should come on and remain on continuously.

2. Insert the patient cable (metal side up) into the receptacle on the back of the SmartMonitor labeled PATIENT INPUT.

3. Connect the lead wires to the patient cable. Insert the WHITE lead wire into the "RA" socket of the patient cable. Insert the BLACK lead wire into the "LA" socket of the patient cable. Make sure that both lead wires are fully inserted into the color-coded sockets of the patient cable.

4. **Home Models Only:** Connect the lead wires to the FUNCTIONAL SELF-TEST receptacles on the back of the SmartMonitor. Insert the pin end of the WHITE lead wire into the receptacle labeled "RA" under SELF-TEST. Insert the pin end of the BLACK lead wire into the receptacle labeled "LA" under SELF-TEST.

   Hospital Models Only: Squeeze the lead wire clips around the 9185A self-test adapters. Insert the adapter with the WHITE lead wire attached into the "RA" receptacle, and insert the adapter with the BLACK lead wire attached into the "LA" receptacle on the back-panel.

5. If you will be using the Remote Alarm, connect it to the REMOTE ALARM output on the back of the Monitor at this time. Turn the Remote Alarm power to on. Each time the Monitor alarms, verify that the sound can be heard through the Remote Alarm and that the Monitor light on the Remote Alarm comes on.

6. Press the POWER button to turn the SmartMonitor on. The alarm should beep and all the lights should come on for approximately two seconds. After all the alarm lights turn off, the CHARGER light should remain on and the green HEART and RESPIRATION lights should be blinking. The lights will continue to flash for about 30 seconds.

7. **Hospital Models Only:** Verify that the initial LCD reading is 155 $\pm$5 BPM and 60 $\pm$4 BrPM.

NOTE: If the following lights remain on or are blinking, and/or the alarm sounds continuously, corrective action should be taken before continuing the Checkout Procedure.

A. **LOW BATTERY** - The SmartMonitor battery pack is discharged. Turn the SmartMonitor off using the correct power-off procedure. Make sure the Battery Charger is plugged into a live power outlet and properly connected to the SmartMonitor. Allow the SmartMonitor to recharge for 24 hours before performing the Checkout Procedure. This will provide fully charged battery power.

B. **FULL MEMORY** - (900SL, 950S, 970S, 970SE, 970SE-10 only). The SmartMonitor's memory is 80% to 100% full. If the SmartMonitor has been used on patients, the memory should be transferred to a Memory Disk, then cleared using the procedure described in the *Professional Operator's Manual.*

C. **LOOSE CONNECTION** - Indicates loose or bad lead wires or patient cable. Check all connections and/or replace lead wires first, then patient cable if necessary.

FUNCTIONAL SELF-TEST (continued)

8. After approximately 30 seconds, the green HEART and RESPIRATION lights should stop blinking. The red LOW light should illuminate within approximately seven seconds after the HEART light stops flashing, and the audible alarm should beep once every second.

9. The next light to illuminate should be the red APNEA light. (There should be no green HEART or RESPIRATION lights during this alarm.) When the APNEA light illuminates, the Functional Self-test is complete.

10. Turn the Remote Alarm off.

11. Turn the SmartMonitor off using the correct Power-Off procedure :

    - Press and hold the RESET button (Home Models only).
    - Press and release the POWER button.
    - Wait until the monitor alarmss, then release the RESET button (Home Models only).

If the Home SmartMonitor is not powered off correctly, the alarm will sound continuously. This is the "sibling" alarm. To correct a "sibling" alarm, press the POWER button to ON, press and hold the RESET button, press and release the POWER button, wait two seconds, then release the RESET button. Repeat the proper Power-Off procedure as described above (Step 11).

SECTION I. CHECKOUT PROCEDURE FOR SMARTMONITOR

SETUP

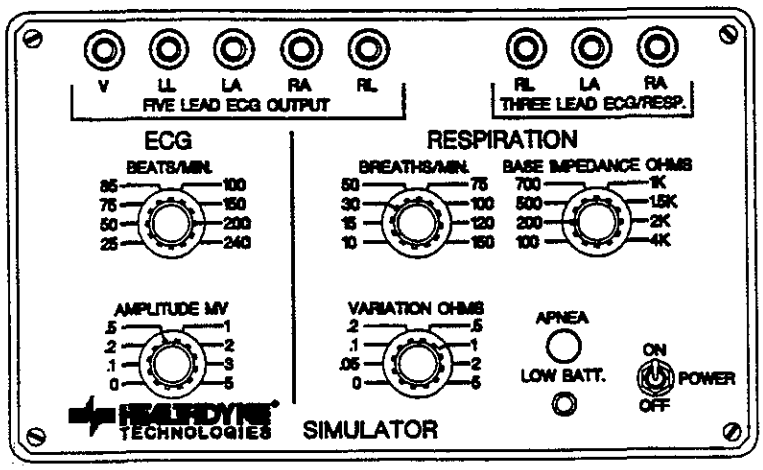
1. The Battery Charger and the Patient Cable should remain connected to the SmartMonitor as they were in the Functional Self-Test.

2. Disconnect the lead wires from the SELF-TEST output of the SmartMonitor. Loosen the binding post caps (labeled "RA" and "LA") on the Model 5000 Simulator under THREE LEAD ECG/RESP.

   Home Models Only: Insert the white lead wire into the post labeled "RA" and the black lead wire into the post labeled "LA." Tighten both post caps on the Simulator.

   Hospital Models Only: Insert the 9185A Adapters into the RA and LA posts. Tighten both post caps on the Simulator. Attach the lead wires from the SmartMonitor to the adapters, making sure that the white lead wire attached to the post labeled "RA" and the black lead wire is attached to the post labeled "LA."

3. Set the Simulator controls as follows:



CONTROL	SETTING
RESPIRATION	
BASE IMPEDANCE OHMS	200
VARIATION OHMS	1
BREATHS/MIN	30
ECG	
BEATS/MIN	200
AMPLITUDE MV	0.5

4. Turn the Simulator POWER on.

5. Turn the SmartMonitor power on and proceed to Verification of Respiration Signal Sensitivity. Look at the identification label on the bottom of the monitor to determine the Type number, then proceed to the next section, *Verification of Respiration Signal Sensitivity*, for that type Monitor.

NOTE: If you have a Home Model 900S, 950S, or 970S which is a Type 01, contact Product Service immediately for update instructions.

VERIFICATION OF RESPIRATION SIGNAL SENSITIVITY FOR HOME SMARTMONITOR TYPES 1A and 1B ONLY

There are ten test points that require different simulator settings. For each test point, make the required changes as listed in the following table and verify the appropriate SmartMonitor response.

NOTE: Due to large signal changes that result when Simulator settings are initially changed, the offscale signal recognition circuitry of the SmartMonitor may activate and cause brief pauses in detection. Once normal signal detection by the monitor resumes, allow an additional 10 seconds for the circuits to stabilize prior to proceeding with verifying the operation of the SmartMonitor. Simulator setting value changes from the previous Test Point are marked with an asterick (*).

Test Point	Simulator Setting		SmartMonitor Response
1	Respiration Breaths/Min	150*	No Alarms
	Variation Ohms	2*	100% Detection
	Base Impedance Ohms	200	
	ECG Beats/Min	200	
	ECG Amplitude/MV	0.5	
2	Respiration Breaths/Min	100*	No Alarms
	Variation Ohms	1*	100% Detection
	Base Impedance Ohms	200	
	ECG Beats/Min	200	
	ECG Amplitude/MV	0.5	
3	Respiration Breaths/Min	75*	No Alarms
	Variation Ohms	0.5*	100% Detection
	Base Impedance Ohms	200	
	ECG Beats/Min	200	
	ECG Amplitude/MV	0.5	
4	Respiration Breaths/Min	30*	No Alarms
	Variation Ohms	0.2*	100% Detection
	Base Impedance Ohms	200	
	ECG Beats/Min	200	
	ECG Amplitude/MV	0.5	
5	Respiration Breaths/Min	30	No respiration detection
	Variation Ohms	0*	Red APNEA light should
	Base Impedance Ohms	200	illuminate and audible
	ECG Beats/Min	200	alarm should beep 20
	ECG Amplitude/MV	0.5	seconds (+/- 1) after last respiration is detected.

VERIFICATION OF RESPIRATION SIGNAL SENSITIVITY FOR HOME SMARTMONITOR TYPES 1A and 1B ONLY(continued)

Test Point	Simulator Setting		SmartMonitor Response
6	Respiration Breaths/Min Variation Ohms Base Impedance ECG Beats/Min ECG Amplitude/MV	100* 1* 200 200 0.5	100% detection. Audible alarm should stop. Press RESET button to reset APNEA light.
7	Respiration Breaths/Min Variation Ohms Base Impedance Ohms ECG Beats/Min ECG Amplitude/MV	100 0 * 200 200 0.5	No respiration detection. Red APNEA light should illuminate and audible alarm should beep 20 seconds (+/- 1) after last respiration is detected.
8	Respiration Breaths/Min Variation Ohms Base Impedance Ohms ECG Beats/Min ECG Amplitude/MV	150* 2* 200 200 0. 5	100% detection. Audible alarm should stop. Press RESET to reset APNEA light.
9	Respiration Breaths/Min Variation Ohms Base Impedance Ohms ECG Beats/Min ECG Amplitude/MV	150 0* 200 200 0.5	No respiration detection. Red APNEA light should illuminate and audible alarm should beep 20 seconds (+/- 1) after last respiration is detected.
10	Respiration Breaths/Min Variation Ohms Base Impedance Ohms ECG Beats/Min ECG Amplitude/MV	150 2* 200 200 0.5	100% detection. Audible alarm should stop. Press RESET to reset APNEA light.

VERIFICATION OF RESPIRATION SIGNAL SENSITIVITY FOR ALL SMARTMONITORS EXCEPT HOME SMARTMONITOR TYPES 1A and 1B

There are ten test points that require different simulator settings. For each test point, make the required changes as listed in the following table and verify the appropriate SmartMonitor response.

NOTE: Due to large signal changes that result when Simulator settings are initially changed, the offscale signal recognition circuitry of the SmartMonitor may activate and cause brief pauses in detection. Once normal signal detection by the monitor resumes, allow an additional 10 seconds for the detection circuits to stabilize prior to proceeding with verifying the operation of the SmartMonitor. After a change in rate, it will take an additional 10-30 seconds for the rate display to reach its specified value. Simulator setting value changes from the previous Test Point are marked with an asterisk (*).

Test Point	Simulator Setting		SmartMonitor Response
1	Respiration Breaths/Min	150*	No Alarms
	Variation Ohms	2*	100% Detection
	Base Impedance Ohms	200	
	ECG Beats/Min	200	Hospital Model Display:
	ECG Amplitude/MV	0.5	200 ± 6 BPM,150 ± 5 BrPM
2	Respiration Breaths/Min	100*	No Alarms
	Variation Ohms	.5*	100% Detection
	Base Impedance Ohms	200	
	ECG Beats/Min	200	Hospital Model Display:
	ECG Amplitude/MV	0.5	200 ± 6 BPM, 100 ± 4 BrPM
3	Respiration Breaths/Min	75*	No Alarms
	Variation Ohms	0.5*	100% Detection
	Base Impedance Ohms	200	
	ECG Beats/Min	200	Hospital Model Display:
	ECG Amplitude/MV	0.5	200 ± 6 BPM, 75 ± 4 BrPM
4	Respiration Breaths/Min	30*	No Alarms
	Variation Ohms	0.2*	100% Detection
	Base Impedance Ohms	200	
	ECG Beats/Min	200	Hospital Model Display:
	ECG Amplitude/MV	0.5	200 ± 6 BPM, 30 ± 3 BrPM
5	Respiration Breaths/Min	30	No respiration detection.
	Variation Ohms	0*	APNEA light should
	Base Impedance Ohms	200	illuminate and audible
	ECG Beats/Min	200	alarm should beep once
	ECG Amplitude/MV	0.5	per second 20 seconds (+/- 1) after last respiration is detected. Hospital Model Display: 200 ± 6 BPM, 0 ± 2 BrPM

FOR ALL SMARTMONITORS EXCEPT HOME SMARTMONITOR TYPES 1A and 1B (continued)

Test Point	Simulator Setting		SmartMonitor Response
6	Respiration Breaths/Min Variation Ohms Base Impedance ECG Beats/Min ECG Amplitude/MV	100* .5* 200 200 0.5	100% detection. Audible alarm should stop. Press RESET button to reset APNEA light. Hospital Model Display: 200 ± 6 BPM, 100 ± 4 BrPM
7	Respiration Breaths/Min Variation Ohms Base Impedance Ohms ECG Beats/Min ECG Amplitude/MV	100 0* 200 200 0.5	No respiration detection. APNEA light should illuminate and audible alarm should beep 20 seconds (+/- 1) after last respiration is detected. Hospital Model Display: 200 ± 6 BPM, 0 ± 2 BrPM
8	Respiration Breaths/Min Variation Ohms Base Impedance Ohms ECG Beats/Min ECG Amplitude/MV	150 2* 200 200 0.5	100% detection. Audible alarm should stop. Press RESET to reset APNEA light. Hospital Model Display: 200 ± 6 BPM, 150 ± 5 BrPM
9	Respiration Breaths/Min Variation Ohms Base Impedance Ohms ECG Beats/Min ECG Amplitude/MV	150 0* 200 200 0.5	No respiration detection. APNEA light should illuminate and audible alarm should beep once per second 20 seconds (+/- 1) after last respiration is detected. Hospital Model Display: 200 ± 6 BPM, 0 ± 2 BrPM
10	Respiration Breaths/Min Variation Ohms Base Impedance Ohms ECG Beats/Min ECG Amplitude/MV	150 2* 200 200 0.5	100% detection. Audible alarm should stop. Press RESET to reset APNEA light. HospitalModel Display: 200 ± 6 BPM, 150 ± 5 BrPM

VERIFICATION OF THE ECG SIGNAL SENSITIVITY FOR ALL TYPE SMARTMONITORS

There are nine test points that require different simulator settings. For each test point, make the required changes as listed in the following table and verify the appropriate SmartMonitor response.

NOTE: Due to large signal changes that result when Simulator settings are initially changed, the offscale signal recognition circuitry of the SmartMonitor may activate and cause brief pauses in detection. Once normal signal detection by the monitor resumes, allow an additional 10 seconds for the circuitry to stabilize prior to proceeding with verifying the operation of the SmartMonitor. Simulator setting value changes from the previous Test Point are marked with an asterick (*).

Test Point	Simulator Setting		SmartMonitor Response
1	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	25* 0.2* 200 1* 15*	100% detection. LOW Heart light should illuminate and audible alarm should beep once per second. Hospital Model Display: 25 ± 3 BPM, 15 ± 2 BrPM
2	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	85* 0.2 200 1 15	100% detection. Audible alarm should stop. Press RESET to reset LOW Heart light. Hospital Model Display: 85 ± 4 BPM, 15 ± 2 BrPM
3	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	85 0.0* 200 1 15	No ECG detection. LOW Heart light should illuminate and audible alarm should beep once per second. Hospital Model Display: 0 ± 2 BPM, 15 ± 2 BrPM
4	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	150* 0.2* 200 1 15	100% detection. Audible alarm should stop. Press RESET to reset LOW Heart light. Hospital Model Display: 150 ± 5 BPM, 15 ± 2 BrPM
5	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	150 0.0* 200 1 15	No ECG detection. LOW Heart light should illuminate and audible alarm should beep once per second. Hospital Model Display: 0 ± 2 BPM, 15 ± 2 BrPM

VERIFICATION OF THE ECG SIGNAL SENSITIVITY (continued)

Test Point	Simulator Setting		SmartMonitor Response
6	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	200* 0.5* 200 1 15	100% detection. Audible alarm should stop. Press RESET to reset LOW Heart light. Hospital Model Display: 200 ± 6 BPM, 15 ± 2 BrPM
7	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	200 0.0* 200 1 15	No ECG detection. LOW Heart light should illuminate and audible alarm should beep once per second. Hospital Model Display: 0 ± 2 BPM, 15 ± 2 BrPM
8	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	240* 0.5* 200 1 15	100% detection. Audibe alarm should stop. Press RESET to reset LOW Heart light. HIGH Heart light should illuminate and audible alarm should beep twice per second. Hospital Model Display: 240 ± 7 BPM, 15 ± 2 BrPM
9	ECG Beats/Min ECG Amplitude/MV Base Impedance Ohms Variation Ohms Respiration Breaths/Min	200* 0.5 200 1 15	100% detection. Audible alarm should stop. Press RESET to reset HIGH Heart light. Hospital Model Display: 200 ± 6 BPM, 15 ± 2 BrPM

VERIFICATION OF THE APNEA ALARM AND DELAY

NOTE: Due to large signal changes that result when Simulator settings are initially changed, the offscale signal recognition circuitry of the SmartMonitor may activate and cause brief pauses in detection. Once normal signal detection by the monitor resumes, allow an additional 10 seconds for the circuitry to stabilize prior to proceeding with verifying the operation of the SmartMonitor.

1. Set the VARIATION OHMS on the Simulator to zero. The audible alarm should sound once per second, and the red APNEA light should illuminate 20 seconds (+/- 1) after the last respiration signal is detected.
2. Set the VARIATION OHMS on the Simulator to 1. The audible alarm should stop, but the red APNEA light will remain illuminated.
3. Press the RESET button on the SmartMonitor to reset the APNEA light.

VERIFICATION OF LOW BREATH RATE ALARM FOR ALL TYPE SMARTMONITORS

1. Set the controls on the simulator to the following values:

ECG Beats/Min	100*
ECG Amplitude/MV	0.5
Base Impedance Ohms	200
Variation Ohms	1
Respiration Breaths/Min	50*

2. Enter the Menu Mode of the SmartMonitor as directed in the ALARM SETPOINTS section on page 3. Change the entry for LOW BREATH RATE from OFF to 16 BrPM.

3. Turn the SmartMonitor off using the correct power-off procedure:

   - Press and hold the blue RESET button (Home Models only).
   - Press and release the white POWER button.
   - Wait two seconds, then release the RESET button (Home Models only).

4. Turn the SmartMonitor POWER on. (The SmartMonitor must be powered off and then on for the changed parameter values to be accepted.)

5. Change the Simulator RESPIRATION BREATHS/MIN setting to 10. Within 20 seconds (+/- 5), the red APNEA light should flash and the audible alarm should beep once per second. The green RESPIRATION light should continue to flash slowly during this alarm condition.

6. Change the RESPIRATION BREATHS/MIN setting to 50. The audible alarm should stop within approximately 7 seconds, but the APNEA light should remain flashing.

7. Press the RESET button to reset the APNEA light.

8. Enter the Menu Mode of the SmartMonitor as directed in the ALARM SETPOINTS section on page 3. Change the entry for LOW BREATH RATE from 16 BrPM to OFF.

9. Turn the SmartMonitor off using the correct power-off procedure:

   - Press and hold the RESET button (Home Models only).
   - Press and release the POWER button.
   - Wait two seconds, then release the RESET button (Home Models only).

10. Turn the SmartMonitor POWER on. (The SmartMonitor must be powered off and then on for the changed parameter values to be accepted.)

VERIFICATION OF THE LOW AND HIGH HEART ALARMS FOR ALL TYPE SMARTMONITORS

NOTE: Due to large signal changes that result when Simulator settings are initially changed, the offscale signal recognition circuitry of the SmartMonitor may activate and cause brief pauses in detection. Once normal signal detection by the monitor resumes, allow an additional 10 seconds for the circuitry to stabilize prior to proceeding with verifying the operation of the SmartMonitor.

1. The Simulator should be set as follows:

ECG Beats/Min	50*
ECG Amplitude/MV	0.5
Base Impedance Ohms	200
Variation Ohms	1
Respiration Breaths/Min	15*

The red LOW Heart light should illuminate and the audible alarm should sound approximately seven seconds after the green HEART flashing light slows down. The RESPIRATION light should continue to flash, and the alarm should beep once per second.

2. After the alarm activates, set the ECG Beats/Min to 200. The audible alarm should stop within approximately seven seconds, but the red LOW Heart light will remain illuminated.

3. Press the RESET button to reset the red LOW Heart light.

4. Change the ECG Beats/Min to 240. The red HIGH Heart light should illuminate and the audible alarm will sound within 10 seconds and should beep twice per second.

5. Change the ECG Beats/Min back to 200. The audible alarm should stop and the red HIGH Heart light will remain on.

6. Press the RESET button to reset the red HIGH Heart light.

VERIFICATION OF CARDIOGENIC ARTIFACT REJECTION FOR ALL TYPE SMARTMONITORS

1. Set the controls on the Simulator to the following values:

ECG Beats/Min	100*
ECG Amplitude/MV	0.5
Base Impedance Ohms	200
Variation Ohms	1*
Respiration Breaths/Min	100*

2. Within 25 seconds, the red APNEA light should illuminate and the audible alarm should sound once per second. No respiration triggering (flashing green RESPIRATION light) should occur *during the alarm condition.* Verify for a 20-second period that the RESPIRATION light does not flash.

3. Set the Respiration Breaths/Min to 75. The audible alarm should stop, but the red APNEA light will remain on.

4. Press the RESET button to turn the APNEA light off.

VERIFICATION OF LOOSE CONNECTION ALARM FOR ALL TYPE SMARTMONITORS

1. Disconnect the Patient Cable from the SmartMonitor. The audible alarm should sound continuously and the LOOSE CONNECTION light should illuminate.
2. Reinsert the Patient Cable. The audible alarm should stop. Press the RESET button to reset the LOOSE CONNECTION light. The green HEART and RESPIRATION lights should resume flashing.
3. Disconnect one lead wire from the Simulator. The audible alarm should sound continuously and the LOOSE CONNECTION light should come on. Reconnect the lead wire. The audible alarm should stop. Then, press the RESET button to turn off the LOOSE CONNECTION light. Repeat this step with the other lead wire.
4. After reconnecting the lead wires, set BASE IMPEDANCE OHMS to 1K on the Simulator. No alarm should sound.
5. Change Base Impedance Ohms to 4K. The audible alarm should sound continuously and the LOOSE CONNECTION light should illuminate.
6. Change Base Impedance Ohms back to 1K. The audible alarm should stop. Press the RESET button to reset the LOOSE CONNECTION light.

VERIFICATION OF ACCIDENTAL POWER-OFF ALARM (SIBLING ALARM) FOR ALL TYPE SMARTMONITORS EXCEPT 900S-10 and 970SE-10 SMARTMONITOR FOR HOSPITALS.

1. Press the POWER button to turn the SmartMonitor off (without pressing the RESET button). The audible alarm should sound continuously.
2. Press the POWER button again, then press and hold the RESET button. Press and release the POWER button. Continue to press the RESET button for two seconds. The audible alarm should stop.

OPERATIONAL VERIFICATION OF THE BATTERIES FOR ALL TYPE SMARTMONITORS

Main Battery Pack

1. Unplug the Battery Charger from the SmartMonitor.
2. Repeat the Functional Self-Test section (Steps 2 - 8 on pages 4 and 5) to verify battery operation.
3. If the battery pack is not sufficiently charged, the alarm will sound continuously, and the LOW BATTERY light will activate.

The main battery pack has a life expectancy of of 2-3 years and should be replaced on a preventative basis within this time frame.

OPERATIONAL VERIFICATION OF THE BATTERIES (continued)

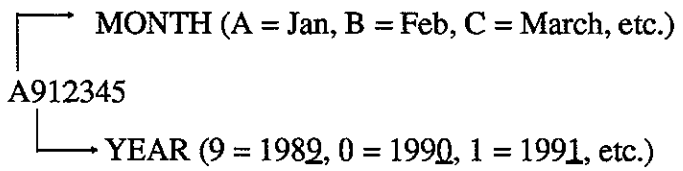
Memory Battery

At least once every five years, Type 03 and later home SmartMonitors and all 970SE-10 SmartMonitors should be returned to Healthdyne for replacement of the memory back-up battery attached to the memory circuit board.

Clock Chip Battery

Once every 4-5 years, the SmartMonitor should be returned to Healthdyne for replacement of the clock chip, which contains an internal lithium battery. If this battery is depleted, the monitor will sound a constant alarm, the LCD display will read "ERROR 2," and the memory may possibly be cleared, causing the alarm and record parameters to be set to standard values.

To determine the age of a SmartMonitor, look at the serial number:



Healthdyne recommends that you consider replacement of the clock chip if the monitor is $\geq$ 4 years old. Beginning December 1994 and January 1995, a clock chip with a battery life of up to 10 years began to be used in SmartMonitors in production and in service. Consider replacement of the clock chip when these monitors become 8-10 years old.

OPERATIONAL VERIFICATION OF REMOTE ALARM

1. Before using any Remote Alarm, first verify its proper operation by following the instructions that came with the device.
2. Connect a Model 990 Remote Alarm to the REMOTE ALARM output on the back of the Monitor. Move the Remote Alarm at least 25 feet away from the monitor.
3. Turn the Remote Alarm POWER to on.
4. Press the SmartMonitor POWER button to on. Repeat Steps 5 - 9 of the Functional Self-Test on pages 4 and 5.
5. Go to the location of the Remote Alarm. Make sure you can also hear the alarm through the Remote Alarm and that the MONITOR light on the Remote Alarm is on. This light will come on each time the Monitor alarms.
6. Turn the Remote Alarm POWER off.
7. Turn the Monitor POWER off (refer to Step 11 on page 5).

****WARNING****

IF YOUR SMARTMONITOR DOES NOT PASS ALL TEST POINTS IN ALL SECTIONS OF THIS CHECKOUT MANUAL, THE SMARTMONITOR MUST NOT BE USED FOR PATIENT APPLICATIONS. FOR TECHNICAL SUPPORT OR PRODUCT SERVICE, PLEASE CONTACT HEALTHDYNE AT (800) 421-8754 OR (770) 499-1212.

This completes the 900S and 900S-10 SmartMonitor testing. For the 900SL, 950S, 970S, 970SE, and 970SE-10 SmartMonitors, proceed to Section II of this *Checkout Procedure Manual.*

SECTION II. CHECKOUT PROCEDURE FOR MEMORY SYSTEM WITH 9500SE SYSTEM SOFTWARE

INTRODUCTION

These tests should be conducted immediately following successful completion of the SmartMonitor stand-alone tests from Section I. This section does not apply to SmartMonitor Models 900S and 900S-10.

If you have not used the 9500 Series software before, please read and be familiar with your 9500 *Operator's Manual.* You may also find it helpful to refer to Chapter 4 of the manual, *Operating Overviews.*

The latest version of the 9500SE software should already be installed on the computer. The printer should be connected and ON LINE, and you should have a blank or recycled Memory Disk available for use.

TESTING OBJECTIVES

The check-out procedures will enable you to verify the following functions of the SmartMonitor:

Computer Retrieval of SmartMonitor Data

- Patient Events Log
- Equipment Events Log
- Equipment Parameters
- Patient Waveforms (Does not apply to 900SL)

SmartMonitor Acceptance of New Equipment Parameters from Computer

- Alarm Settings
- Record Settings
- Time and Date

Verification of the SmartMonitor's memory and communications functions will be accomplished by retrieving the stored data created during the Section I test, printing this data, examining the printout for accuracy, and then clearing the memory of this data. New equipment parameters will then be transferred to the SmartMonitor from the computer and the LCD menu will be checked for these changes.

If the SmartMonitor passes these checks, it may then be considered ready for patient use. Finally, the physician's alarm/record parameter prescription for a patient can be entered into the SmartMonitor and used.

COMPUTER RETRIEVAL OF SMARTMONITOR DATA

Setup

1. First, turn off the SmartMonitor POWER. Connect the 9151 (or 9150) cable from the Computer connector of the SmartMonitor (back panel) to the serial port of the computer.
2. Activate the Communications Mode of the SmartMonitor. Press and **hold** the blue RESET button on the SmartMonitor. Then press the POWER button to ON and release. All the lights will come on and the audible alarm will sound briefly.
3. Release the RESET button. Then, press the RESET button again to silence the audible alarm. The SmartMontitor is now in the Communications Mode.

To confirm that the SmartMonitor is in the Communications Mode, look at the LCD of the monitor; which should display COMM MODE SELECTED.

To Retrieve the Data from the SmartMonitor

1. At the C prompt (C:/), type `go` and then press **ENTER** on the computer.
2. The 9500SE **MAIN Menu** will be displayed. You must create a new patient (test) filename using **C** (Comm). For example, the last name could be "May31Test" and the first name could be "1" (for the first test on that day). You must enter at least a last name and/or number for the last name. See your 9500SE Operator's Manual for complete instructions on creating the Patient File. Press the **ENTER** key after specifying the "name."
3. Initiate Communications with the SmartMonitor using **Comm/F1** from the **MAIN Menu.**
4. Retrieve **Event Logs** and **Equipment Parameters** using the **F2** key. If you are checking out a 900SL, proceed to the next section, *Clear Memory.*
5. Highlight **All Patient Waveforms** using the "+" key, then press **F2.** When the download has been completed, the computer will "beep" for approximately five seconds to notify you.
6. Highlight **Select Patient Waveforms** using the "+" key. The Patient Events Log will be displayed. Look for 'p' after each event number to confirm the presence of each waveform file.
7. Press the **ESC** key to return to the **Communications** screen.

Clear Memory

1. After the data and waveforms are retrieved, clear the SmartMonitor's memory by pressing the **SHIFT** and **F2** keys and following the prompts.
2. Press **ESC** to disconnect from Communications and return to the **MAIN Menu.**

Display Reports

1. Select **REPORTS** from the **MAIN Menu** and press the **ENTER** key.
2. Select **preView** and press the **ENTER** key.
3. Commonly used reports will already be highlighted. Use the plus ("+") key to select additional reports for display. Use the minus ("-") key to deselect reports.
4. Press the **F1** key to display the selected reports. The data you downloaded from the complete simulator test from Section I will be displayed. Follow the prompts on the screen to page through each report.
5. Press the **ESC** key to disconnect from the Reports Menu and return to the **MAIN Menu**. If the above reports, logs, and parameters were transferred to the computer then you have verified proper computer retrieval of SmartMonitor data.

Print Data

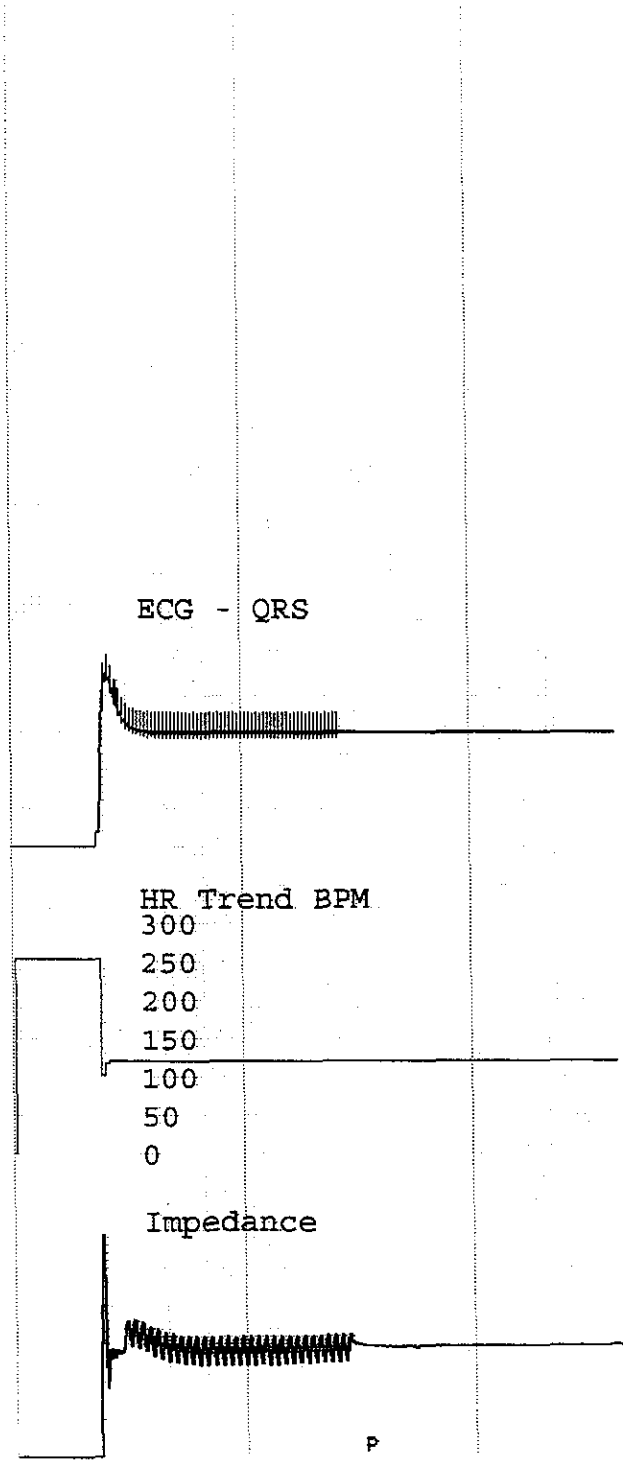
1. Insert a blank or recycled Memory Disk.
2. Press the **F4** key and follow the prompts to save current patient data to a Memory Disk.
3. Press the **F9** key to process waveforms.*
4. Connect the appropriate cable for the printer you will be using to the printer's PARALLEL or INPUT connector and to the computer's PARALLEL/PRINTER OUTPUT connector. Make sure the printer is on and ON LINE.
5. Follow the appropriate printing instructions in the 9500 Software *Operator's Manual* for the type of printer you will be using.
6. Print the default reports and all E-GRAM® Reports.*

* **NOTE:** The 900SL will not have waveforms or E-GRAM Reports.

Verify Data Points (Does not apply to 900SL)

1. Choose one of the printed waveforms. Match the printed E-GRAM setpoints (lines 12-17, 37) with the Alarm Parameters For Stand-Alone Tests listed in Section I. Refer to the sample E-GRAM Reports on the following pages.
2. Check for a printout of the **Equipment** and **Patient Events Logs**, and the **Equipment Parameters** file. If the above reports, logs, waveforms and parameters were transferred to the computer, and the setpoints match, then you have verified proper computer retrieval and printing of SmartMonitor data.

```
E-GRAM (R) Report 9500SE F
   1 Event: 001
   2 Name:
   3 6FEB95, TEST
   4 Report Date:     2/06/95
   5 Transfer Date:   2/06/95
   6
   7 Start Date:      2/03/95
   8 Start Time:     15:17:16
   9 Pri. Duration: 00:00:33
  10 Alarms, Pri/Sec:  b/BaA
  11 Alarms: Pri/Sec/Set
  12 Brady :  b   B   80  BPM
  13 Br Del:  -   -    5  sec
  14 Apnea :  -   A   20  sec
  15 Ap Rec:  -   a   16  sec
  16 LoBrRt:  -   -  Off  BrPM
  17 Tachy :  -   -  230  BPM
  18 Oximtr:  -   -  Off  %
  19 ExtInp:  -   -  1-Off  2-Off
  20
  21
  22
  23
  24 Pri. Apnea Apprx:    0 sec
  25 Lowest Heartrate: 103 BPM
  26
  27 ---------------------------
  28 Event Classification: _____
  29 Scored Apnea Dura:     sec
  30 Scored Brady Dura:     sec
  31 Scored Desat Dura:     sec
  32 Scored Heart Rates (BPM):
  33
  34 Scored Desat Values  (%):
  35
  36 ---------------------------
  37 Pre/Post Time: 45/15  sec
  38 Chartspeed: 1.0 mm/sec.
     HEALTHDYNE  Paper #9401/8021
```



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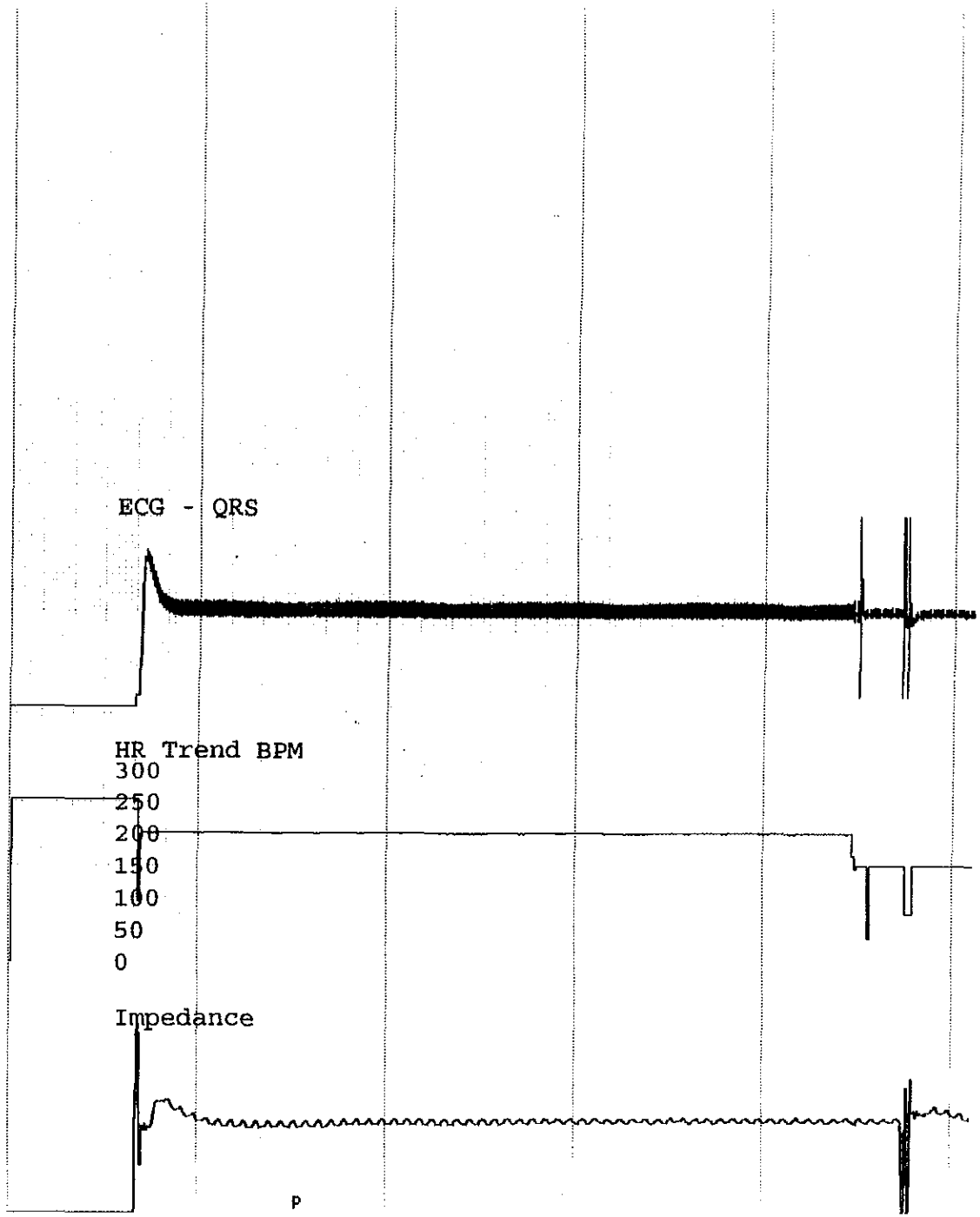
Self-Test Sample

E-GRAM (R) Report 9500SE F

```
  1 Event: 002
  2 Name:
  3 6FEB95, TEST
  4 Report Date:     2/06/95
  5 Transfer Date:   2/06/95
  6
  7 Start Date:      2/03/95
  8 Start Time:     15:21:10
  9 Pri. Duration: 00:02:53
 10 Alarms, Pri/Sec:  a/AbB
 11 Alarms: Pri/Sec/Set
 12 Brady :   -    B    80   BPM
 13 Br Del:   -    -     5   sec
 14 Apnea :   -    A    20   sec
 15 Ap Rec:   a    -    16   sec
 16 LoBrRt:   -    -   Off   BrPM
 17 Tachy :   -    -   230   BPM
 18 Oximtr:   -    -   Off   %
 19 ExtInp:   -    -   1-Off  2-Off
 20
 21
 22
 23
 24 Pri. Apnea Apprx: 189 sec
 25 Lowest Heartrate:   8 BPM
 26
 27 ---------------------------
 28 Event Classification: _____
 29 Scored Apnea Dura:     sec
 30 Scored Brady Dura:     sec
 31 Scored Desat Dura:     sec
 32 Scored Heart Rates (BPM):
 33      ___  ___  ___
 34 Scored Desat Values  (%):
 35      ___  ___  ___
 36 ---------------------------
 37 Pre/Post Time: 45/15  sec
 38 Chartspeed: 1.0 mm/sec.
    HEALTHDYNE  Paper #9401/8021
```



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SMARTMONITOR ACCEPTANCE OF NEW EQUIPMENT PARAMETERS FROM COMPUTER

If you begin this test consecutively with the previous test then you may start with Step 1 below. If you have disconnected the computer and SmartMonitor, then you must reconnect the monitor cable, put the Smart-Monitor in the Communications mode, run the software program (go), and create a Patient Information File using C (Comm) before continuing.

1. At the **MAIN Menu** select the COMM option. Press the **F1** key to re-establish communication with the SmartMonitor.
2. Press the **F2** key to retrieve the first three highlighted options. Wait for the Status Line to read "Connected" again.
3. Press the **F3** key to display the Equipment Parameters screen.
4. Note the "Monitor Date/Time" and the "Current Date/Time." Press the **F4** key to update the "Current Date/Time" to the SmartMonitor. Within 60 seconds, the "Monitor Date/Time" window should match the "Current Date/Time" within one minute.
5. From this screen the parameters may be changed by positioning the cursor on the desired field using the **ENTER** key and/or the up and down arrow keys, and then making changes by pressing the + or - keys. Enter the following parameters:

    a. Record Mode: Event
    b. Pre/Post Alarm Time: 45/15
    c. Apnea Alarm: 10
    d. Apnea Record: 14
    e. Bradycardia Alarm: 100
    f. Bradycardia Alarm Delay: 5
    g. Channel 3: Pulse

6. Press the **F2** key to transmit these changes to the SmartMonitor. When the Status line displays "**Connected,**" exit to the **MAIN Menu** by pressing the **ESC** key as necessary. You may also want to clear the Smart-Monitor's memory as prompted if you have not already done so.
7. **The new changes will take effect only when the SmartMonitor power is turned off, then back on (you may leave the connecting cable attached).** Turn the SmartMonitor off, turn it back on, and enter the Menu Mode (not COMM mode). Refer to Section I (page 3) for instructions on how to enter and display the stored parameter values.
8. Compare the above computer-entered parameter values with those displayed on the LCD. If there was a proper transfer of new parameters, this last test was successful.

You may now consider the SmartMonitor ready for entering the physician's prescribed parameters.

IF YOU EXPERIENCED DIFFICULTIES WITH THESE PROCEDURES, OR IF ANY OF THESE TESTS WERE UNSUCCESSFUL, PLEASE CONTACT HEALTHDYNE TECHNICAL SUPPORT AT (800) 421-8754 OR (770) 499-1212.

Date Received: _____
Technician: _____
Serial No.: _____

HEALTHDYNE® TECHNOLOGIES

SMARTMONITOR® Operational Verification Checklist

Initial Checkout

Indicate completion of each item below using a (✓).

_____ Visual Inspection
_____ Apnea Alarm
_____ High Heart Rate Alarm
_____ Loose Connection Alarm
_____ Battery Power
_____ Remote Alarm
_____ Parameter Changes (Memory Monitors Only)
_____ Functional Self-Test
_____ Low Breath Rate Alarm
_____ Low Heart Rate Alarm
_____ Cardiogenics Alarm
_____ Accidental Power-Off (Home Models Only)
_____ Data Retrieval (Memory Monitors Only)

Respiration Sensitivity Test Points #1_____ #2_____ #3_____ #4_____ #5_____ #6_____ #7_____ #8_____ #9_____ #10_____
ECG Sensitivity Test Points #1_____ #2_____ #3_____ #4_____ #5_____ #6_____ #7_____ #8_____ #9_____

Date	Visual Inspection	Functional Self-Test	Apnea Alarm	Low Breath Rate Alarm	Low Heart Rate Alarm	High Heart Rate Alarm	Cardiogenics Alarm	Loose Conn. Alarm	Accidental Power-Off	Battery Power	Remote Alarm	Data Retrieval	Parameter Changes	Technician

NOTE: This checkout sheet should be used with, but not in place of, the Checkout Procedure Manual (Part #925).